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THE PRODUCTION OF WHITE BURLEY TOBACCO

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THE PRODUCTION OF WHITE BURLEY TOBACCO

By E. J. KINNEY*

The name "White Burley" refers both to a variety of tobacco and to the cured leaf of that variety. White Burley is the favorite type of leaf for the manufacture of chewing and smoking tobaccos for domestic use, and is also used very extensively in the manufacture of the American cigarette. Perhaps one-third of the leaf is now used in cigarettes. Practically the entire crop—which has averaged over 300,000,000 pounds annually in recent years—is consumed in this country. Nearly 70 percent of all Burley is grown in Kentucky.

VARIETIES OR STRAINS OF WHITE BURLEY

White Burley tobacco originated in 1864 as a sport or mutation from one of the dark, or Virginia, varieties still used to produce the dark leaf of western Kentucky and Virginia and the flue-cured tobaccos of Virginia and the Carolinas. White Burley differs from all other kinds of tobacco in the appearance of the growing plants. It has cream-colored stalks and leaf veins and very light green leaves. *White Burley*—not Burley—is the varietal name, indicating the light color of the plants. Apparently the original White Burley was not a fixed type, and numerous strains or sub-varieties have been developt, differing in character of the plants, length of time required to mature, and shape and texture of the leaves. For many years after its discovery, White Burley was used principally for the manufacture of plug tobacco. For this purpose a heavy grade of leaf is preferred; consequently varieties that produced a large proportion of such leaf were developt and were generally grown. The so-called Red White Burley, Rainbow White Burley, Yellow and Red Twist-

* Methods of controlling tobacco insects advocated in this circular are the recommendations of the Kentucky Experiment Station Department of Entomology and Botany. The section on plant diseases was written by Dr. W. D. Valleau, Station Plant Pathologist, and the paragraphs on Government grading and production and disappearance of White Burley by Dana G. Card, Assistant in Marketing, Kentucky Experiment Station.

bud White Burley, and Big Silk White Burley were among the popular varieties in former years.

Beginning about 40 years ago, a constantly increasing percentage of the White Burley crop has been utilized for the manufacture of smoking tobacco and more recently for cigarettes. At present the amount used for these products greatly exceeds that used for making chewing tobacco. In the manufacture of smoking tobacco and cigarettes, a large proportion of light, colory leaf must be used in order to give the products good burning qualities, an attractive color and mild flavor. Manufacturers found difficulty in most seasons in securing the needed amounts of such grades of leaf, and they soon began to command much higher prices than the heavier red grades. In order to produce as much colory leaf as possible, growers have largely discontinued the use of the old Burley varieties and are growing instead varieties that produce leaf with light body, which gives better color when cured. While these varieties give smaller yields than the heavy varieties, the better quality more than compensates for the lower yield. As yet no variety has been produced that gives both color and heavy yield. In tests at the Kentucky Experiment Station the lighter varieties yielded about 200 pounds per acre less than the heavy, when the yield of the latter ranged from 1200 to 1500 pounds per acre. On land in especially good condition the medium heavy sorts give good quality, as a rule, and can be safely used.

Most of the leading strains of light tobacco happen to be of the standing-up type; that is, the leaves grow more or less upright instead of drooping. However, the lightest variety of tobacco ever grown in the White Burley district—the original Halley—was a drooping type, whereas several standing-up varieties have been developt that produce heavy red leaf. The most extensively grown of the standing-up varieties are the Kelley, Judy's Pride, Halley's Special, Gay's Yellow, Pepper, Shipp's and the Kentucky Experiment Station Root-rot Resistant strains. The Greenbrier is an excellent drooping type, and some of the Twist-bud strains give quite colory leaf. Seed of these and also of the older, heavier sorts is difficult to obtain at the present time. The Kentucky Experiment Station root-rot resistant strain of White Burley No. 16 is the latest

of the resistant strains to be released. It has proved to be very resistant to root rot and gives good yields of excellent quality leaf. The purchaser of seed should designate the strain he desires, not ask for simply "White Burley" or "Improved White Burley," as all strains are White Burley.

FIGURE 1. A field of white Burley tobacco, after topping.

SOIL FOR WHITE BURLEY TOBACCO

Good drainage of both surface and subsoil is especially necessary for the production of good White Burley tobacco. The excellence of the Bluegrass soils of Kentucky for Burley production probably may be attributed primarily to the porous nature of the subsoil, which permits surplus water to drain away quickly. Good drainage also means good aeration which seems to be an important factor in producing smooth, colory leaf. The soil must be well supplied with plant food. White Burley is distinctly a rich-land tobacco, and attempts to raise it on poor soils or even those of moderate fertility are certain to give disappointing results, unless manure or fertilizers, or both, are used liberally.

Neither manure nor fertilizers gives a good crop, however, on compact soil low in organic matter, as physical condition of the soil is perhaps equally as important as plant-food content. Heavy

sod, especially bluegrass sod, gives good physical condition and, if of long standing, is likely to be rich in available plant food. Orchard-grass sod and red-top sod seem to be satisfactory also. In the coarser, more open soils, such as occur in the hilly parts of the Bluegrass Region, good quality of leaf may be produced after clover or lespedeza. Good leaf may often be obtained following corn or the small grains provided the soil is well supplied with organic matter. With a crop as expensive to grow as tobacco, it is highly profitable to provide the best possible soil conditions for its growth. On heavy soil or soil not in good physical condition, it is perhaps more profitable to attempt to produce as large a yield as possible, rather than fancy leaf.

FERTILIZERS FOR WHITE BURLEY TOBACCO

The fertilizer experiments on the Kentucky Experiment Station farm at Lexington show that nitrogen is the most important element for tobacco in the Central Bluegrass Region, since it produces a larger increase in yield than the other elements. Outside the Bluegrass Region, phosphorus gives the largest increase. A fertilizer analyzing 4 to 6 percent of nitrogen, 8 to 12 percent of phosphoric acid, and 6 to 8 percent of potash is probably as satisfactory as any that can be used. More potash may prove profitable in some instances and it is advisable to try larger amounts of potash to determine how much ought to be applied. For those who prefer to mix their own fertilizer, 4 parts of nitrate of soda or 3 parts of sulfate of ammonia, 5 parts of superphosphate, and 2 parts of a mixture of equal parts of muriate and sulfate of potash give a satisfactory mixture. Muriate of potash may be used where applications are light. A mixture of the two forms is a good practice.

The amount of fertilizer to use depends upon the productivity of the soil. For soils that will make 40 to 50 bushels of corn per acre in a good season, 500 to 600 pounds per acre is recommended; for soils making 50 to 60 bushels, 400 to 500 pounds. Fresh soil in a very productive condition may not require fertilizers to produce good crops of Burley; especially is this true in the Central Bluegrass Region. A side dressing of 100 to 200 pounds of nitrate of soda per acre or equivalent amount of other soluble nitrogen fertilizer often may be used profitably to stimulate a slow-growing crop.

EFFECT OF FERTILIZER ON QUALITY

In the limestone region of Central Kentucky, fertilizers seem to have very little effect upon quality in the average season, except where the soil is not sufficiently productive to give a fair growth of plants. An excessive amount of nitrogen fertilizer or heavy application of manure may affect quality on soils where drainage is slow and aeration imperfect. On "quick" soils, even very large amounts of nitrogen fertilizer seem not to be injurious. In sections where soils are deficient in phosphorus, the use of phosphate in the fertilizer usually improves quality materially. The same thing is doubtless true of potash. Where the weather following transplanting is cool and wet, commercial fertilizers may have a decidedly beneficial effect upon both yield and quality. In 1929, when such seasonal conditions occurred, fertilized tobacco maintained a steady growth thruout the wet period and was sufficiently mature to harvest before the drouth which followed became severe enough to cause injury. This early-maturing tobacco gave good yields of excellent quality leaf. On the other hand, much unfertilized tobacco made a very slow growth during the early part of the season and the drouth prevented its development later. Such tobacco gave low yields of poor quality leaf.

Lime is not often of direct benefit to tobacco; in fact, tobacco planted on land that has recently been heavily limed may be injured. Indirectly, lime may be of benefit by making better grass and clover in the tobacco rotation. Its beneficial effects may be obtained without much danger of any unfavorable results by using moderate applications on the crop following tobacco in the rotation.

APPLYING COMMERCIAL FERTILIZERS

Unless a very large amount of fertilizer is used, row application is preferable to broadcasting. Four hundred to six hundred pounds per acre, perhaps much more, can be used safely in the row if properly applied. One of the most difficult problems connected with fertilization of tobacco is to get proper placement of the fertilizers. This is particularly true with machine setting of Burley. The best placement for Burley tobacco is in continuous narrow bands on both sides of the row and about 3 to 4 inches from the plants. The depth of placement should be 3 to 4 inches. Some

of the setters sold recently have fertilizer distributors which make such placement, but the older ones do not. Most growers have single row fertilizer distributors, and fairly good placement can be made with them if proper care is exercised. The best method is to mark out the land and to run the drill on both sides of the row, leaving a space of 6 to 8 inches between the bands of fertilizer. The tobacco should be set between the bands. Another method is to drill the fertilizer directly in the row a week or ten days before setting the tobacco. It should be mixed with the soil by following the drill with a double-shovel plow or Rastus cultivator with narrow shovels. On the Experiment Station farm, fertilizers have been applied successfully by using two-horse corn planters with fertilizer attachments. The land is marked out and the fertilizer drilled on both sides of the row. Potato planters with fertilizer attachments make a very satisfactory placement, but they do not drill small amounts of fertilizer very evenly.

The rate at which any distributor delivers fertilizer varies greatly, depending upon the amount of moisture in the fertilizer, its mechanical condition, and what materials are used in its manufacture. It is necessary, therefore, to test the drill to determine how much fertilizer is being sown. This can be done by weighing out a definite amount of fertilizer—say 20 pounds—and noting how many feet of row it sows. At the rate of 100 pounds per acre, 20 pounds should sow 2500 feet of row; at a 200 pound rate, 1250 feet; at a 300 pound rate, 825 feet; and at a 500 pound rate, 500 feet.

MANURE FOR BURLEY TOBACCO

At the Kentucky Experiment Station stable manure has been as effective as fertilizer. Ten tons per acre of average farm manure should be sufficient on soils in fair condition, and for thin soil the amount may well be increased to 15 tons per acre. Outside the Central Bluegrass counties manure should be supplemented by about 200 pounds per acre of superphosphate drilled in the rows. Manure may be slightly more effective if used as a top-dressing after the ground is plowed; however, if coarse and strawy, it cannot be used in this way. Chicken manure, especially if quite dry and free from straw or other bedding material, contains much more plant food than ordinary stable manure and less need be used. A top-dressing of 4 to 5 tons per acre should give good results.

RAISING THE PLANTS

The growing of plants is fully discussed in Kentucky Extension Circular 77, entitled "Tobacco Plant Bed Management." It will be sent free on request. Only a few of the most important features of plant growing will be considered here.

The best land on the farm should be selected for the plant bed. New ground or old sod land is best. It is best to use a new site each year in order to avoid root-rot and other diseases.

The use of fertilizers is a wise precaution, even when it is thought the soil is very fertile. Fertilizers are preferable to manure, as a rule. Tobacco stalks should not be used, because they may introduce disease. The fertilizer used should contain at least 3 percent of nitrogen. Little or no potash is required where beds are burned, but it should be included where beds are steamed. Three to four pounds of fertilizer per hundred square feet of bed is a liberal application; it is not advisable to use more than 5 pounds on any soil in Kentucky. The fertilizer should be applied after the bed is burned or steamed, and raked into the soil.

Where plants make an unsatisfactory growth, the application of 5 gallons of a solution of 10 pounds of nitrate of soda in 50 gallons of water to each 200 square feet of bed is often of great benefit. The solution should be sprinkled over the bed with a sprinkling can and should be followed with an equal amount of clear water to prevent injury to the plants.

Plants should never be allowed to suffer for water. Watering a bed is a big task, but it pays well in dry periods. A thoro wetting once a week is far better than frequent light sprinklings. A barrel of water to each 100 square feet of bed is not too much.

One half a level teaspoonful of good recleaned seed to 100 square feet of bed is ample. Many experienced growers use only about one-fourth to one-third teaspoonful. An ounce of seed is sufficient to plant a bed 250 feet long and 9 feet wide. If each ounce of seed is mixed thoroly with a peck or more of slightly moist—not wet—sand or ground limestone even distribution, even in windy weather, is possible. At least 200 square feet of bed should be allowed for each acre of tobacco to be grown.

PREPARATION FOR PLANTING

Fall plowing of heavy sods is desirable. In case this is not practicable, the breaking should be done in early spring. For other lands, early spring plowing is best. Cover crops of rye or other grains should be plowed under when about 12 to 15 inches tall. It is a mistake to permit the growth to become large. Disking at intervals is necessary to keep down grass and weeds. Dragging puts the land in good condition for transplanting.

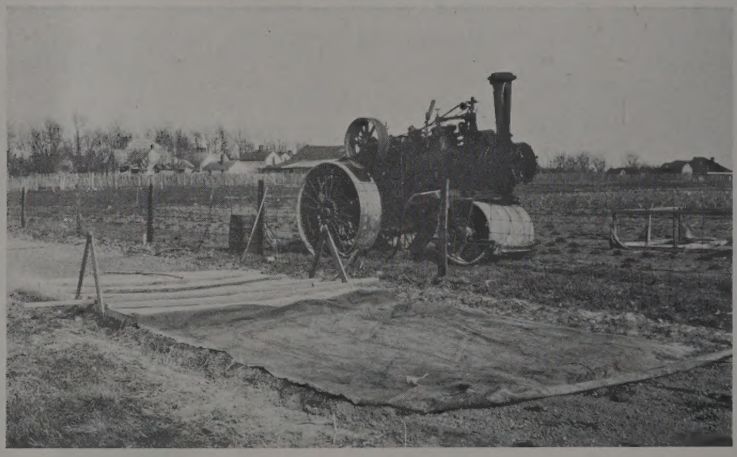

FIGURE 2. Steaming a tobacco plant bed.

TRANSPLANTING

Close setting in the row tends to give a light leaf. It is doubtful, however, if it is practical to set closer than 16 inches. On hill land where moisture is more likely to be deficient, it is not wise to set closer than 18 to 20 inches apart. Rows should be 3½ feet apart. A few growers are placing rows closer but experiments indicate no advantage in this and it certainly does add to the cost of production. Machine transplanting is preferable to hand setting. The latter part of May and the first part of June is the best transplanting period. July 1 may be regarded as very late setting, with only a fair chance of producing a good crop.

CULTIVATION

The chief benefit of cultivation is killing weeds. Preventing the formation of a soil crust also saves moisture while the plants are small. It is desirable to go over the field with hoes as soon as the plants start growing, to check weeds and break up the crust around the plants. Earth should be drawn around plants having long shanks. Further hoeing is necessary only to keep down weeds. Fairly shallow, frequent cultivations should be given until the spreading leaves make it impossible to get thru the rows without damaging the plants.

TOPPING AND SUCKERING WHITE BURLEY TOBACCO

Light-colored White Burley tobacco leaf sells for two to four times as much as red leaf. Obviously the profit realized in raising this type of tobacco is determined chiefly by the percentage of colory grades in the crop. The color of cured Burley depends largely upon the thickness, or body, of the leaves. The thinner the leaf, the lighter the tobacco cures, as a rule, provided the curing is properly done; consequently, growers should make every effort to produce thin-leaf Burley.

In some seasons the method followed in topping and suckering has considerable influence in determining leaf thickness. Topping the plants as soon as the flower bud appears and keeping suckers closely pulled, as used to be the general practice in the Burley district, tend to give heavy body. This is because materials that would otherwise be used to produce seed heads or large suckers are transferred to the leaves. Obviously then, deferring topping until the plants are in full bloom, or perhaps later, or permitting a heavy growth of suckers to develop tends to give a thin leaf. Of course the total yield may also be reduced considerably. In fact, as most growers realize, it is impossible to get both maximum yield and high quality Burley.

Various methods of topping and suckering Burley have been tested at the Kentucky Experiment Station during the past ten years. Delaying topping until the plants are in full bloom and one suckering just before harvest is recommended as the most practical method. It is the least laborious and gives as light color as

any method tried. This late-topped tobacco is ready to harvest, in most years, in about two weeks after topping. Any suckers that may have started are pulled when the tobacco is topped, and usually the crop can be cut before the new growth of suckers becomes over large. When the weather is very favorable for the growth of suckers it may be advisable to partially sucker the crop once in addition to the final clean up before harvest. Only the largest suckers need be removed, however.

Medium early topping and permitting one or two top suckers to develop gave very satisfactory results in the Station tests, and about the same yield as deferred topping. It requires more work, however, since all except the top suckers must be removed, and the suckers themselves must be topped.

The poorest results were obtained where the tobacco was not topped until ready to harvest. The bright leaf cured dark, and the total yield was the lightest of any method. Topping seems to make for uniform ripening.

Some growers allow the tobacco to bloom and, in topping, only the seed head is removed, all the stalk being left. At harvest time the plant is again topped down to a good-sized leaf. This method seems to be quite satisfactory. A few growers do not top until harvest but strip off the small leaves below the bloom. There seems to be little to recommend this system.

HARVESTING

The yellowing of the lower leaves, if not the result of drouth, or excessive moisture, indicates that White Burley is beginning to mature. The yellowing gradually extends to the leaves higher up on the plant until, in fully ripened Burley, even the top leaves may be quite yellow. If seasonal conditions permit, the tobacco should always be allowed to ripen well before harvesting. Some years ago it was believed that Burley cut before fully mature colored better in curing than fully ripe plants. But few growers believe this at the present time; rather it is the general opinion that when the leaves are not being damaged, it pays to let the plants stand until all the leaves are yellowed. The yield of Burley may be considerably reduced by cutting green and the crop is more liable to

damage in the barn than ripe tobacco in case of unfavorable curing weather.

White Burley tobacco is very susceptible to drouth, especially the varieties grown chiefly at the present time, and even in moderately dry weather the lower leaves turn yellow and begin to burn regardless of the stage of maturity. It is always difficult to decide whether to cut the crop when it begins to burn badly or to defer cutting in the hope that rain will occur soon. If the tobacco has not been topped it probably pays to wait for a rain. If it has been topped, however, and is wasting badly, it usually proves more profitable to cut it. The upper leaves do not cure well when tobacco is cut at a very immature stage but the lower leaves make a very good quality of cured leaf. On the other hand, Burley that has almost completed its growth before it is affected by drouth seldom makes choice leaf if allowed to stand until rain occurs.

Splitting the stalk has been the most common practice in harvesting White Burley tobacco, but in recent years spearing has also been practiced extensively. In splitting, the stalks are split to within a few inches of the ground before cutting the plants, which are then straddled over the sticks. In spearing, the stick is pushed firmly into the ground and a spear head placed on the top end. The plant is then speared thru the stem near the butt and so forced down on the stick. Tobacco sticks should be well sharpened, so they can be forced into the ground easily. Splitting the stalk is possibly slightly preferable to spearing where experienced labor is available. The tobacco cures more rapidly, and is less likely to be attacked by houseburn in damp weather. Spearing is a more rapid way of harvesting, however, and requires less skill. In ordinary seasons, it is just about as satisfactory as splitting.

White Burley tobacco sunburns quickly and, in hot, sunny weather, it is not advisable to cut it in the middle of the day unless the sticks of tobacco are piled. In placing tobacco on the sticks, the butts of the plants should be toward the sun. Tobacco should be allowed to wilt a few hours before hauling to the barn, and it should be carefully handled to prevent bruising. Bruised spots on the leaves remain green when curing is completed, which detracts from the appearance of the tobacco and lowers the grade.

CURING

The usual practice in housing White Burley tobacco is to put five to six plants on each stick and space the sticks 7 to 10 inches apart on the tier rails. With small plants, somewhat closer spacing is permissible. Where it is planned to use heat thruout the curing period, it may be fairly safe to hang the sticks somewhat closer than the customary spacing. During protracted periods of very damp weather, however, especially just after yellowing is completed, it may be impossible to prevent houseburn in "crowded" barns, even by very heavy firing. Certainly it is not advisable to space sticks less than six inches apart.

FIGURE 3. Transplanting tobacco by machine.

Given a well-ventilated barn and moderately dry, warm weather, White Burley requires little attention during the curing period. It is best to give as much ventilation as possible until the tobacco is thoroly wilted. If the weather is not abnormally hot and dry, full ventilation may be continued until the leaves begin to dry. When this stage is reached it is necessary to close the side ventilators on windy days to prevent the dry leaves shattering. In occasional seasons, 1936, for example, when the air is extremely dry, it is advisable to keep most of the ventilators closed after the tobacco has wilted,

especially while the leaf is yellowing; otherwise the leaves may cure green because they dry out before yellowing is completed. After the leaf has yellowed, low humidity causes little damage to Burley. Some mottling will often occur (pawpaw leaf) but this is not objectionable to most buyers. Burley, unlike nearly all other types of tobacco, cures best at a relatively low humidity, due most certainly to the relatively small amount of chlorophyll in the leaves. Preliminary experiments at the Kentucky Experiment Station indicate the optimum humidity to be 60 to 65 percent and the optimum temperature 75 to 80° F.

Much cloudy, rainy or damp weather makes it very difficult to get good results in air curing. In fact, it is sometimes almost impossible to prevent injury by houseburn except by using artificial heat. Houseburn is caused by an organism which seems to be always present on the leaves but which causes no damage until the leaves begin to yellow or die, and then only when the weather is damp and warm. Under these conditions, the organisms develop and cause a rotting of the leaves. There are few years that houseburn does not cause considerable loss in all the air-cured tobacco districts, and in some years the losses are very heavy.

When the outside air is warm and saturated with moisture, as during times of almost constant rain and continued cloudiness, no amount of ventilation is of any benefit. If the tobacco is at the "houseburn" stage at such a time, houseburn is certain to develop unless the tobacco is dried out with artificial heat. It is advisable to start firing if the tobacco stays very wet longer than twenty-four hours. Only enough heat should be used to dry off the leaves, and under no circumstances should the temperature exceed 100 degrees, F., any place in the barn. It is especially necessary to avoid high temperature when the tobacco is not fully yellowed, as the green color may be fixed. It is not necessary to continue firing when the weather becomes fair.

Coke is the most practical fuel to use for firing. Petroleum coke has some advantages over gas or by-product coke. It burns freely and it is possible, therefore, to maintain a number of small fires, which gives a good distribution of heat. Petroleum coke can be burned on top of the ground, but better in narrow trenches and still better in stoves. Petroleum coke costs more than common coke,

and if considerable firing has to be done the latter is cheaper to use, even including the cost of stoves.

Gas coke cannot be burned without stoves, and very small fires cannot be maintained very easily. It is customary to use one stove in the center part of each bent. The use of more stoves and smaller fires is advantageous, because the heat is better distributed.

Oil or grease drums make fairly satisfactory stoves for burning coke, and such stoves are widely used. To prepare for use, cut a number of holes about the size of a dollar in the bottom of the drum and around the side, near the bottom. The bottom thus serves as a grate, while the holes in the side permit raking down the ashes. The drum is set on stones or bricks, and after the coke gets to burning well a piece of sheet iron about 3 feet square should be put over the top to spread the heat. It must not rest directly upon the drum, but should be supported on pieces of iron about 2 inches thick laid across the drum top. Commercial stoves are far more convenient than the homemade stoves, largely because the draft may be controlled.

In firing tobacco, all doors and side ventilators should be closed, but roof ventilators should be left wide open. Where barns have metal or composition roofs and are without roof ventilators, openings should be made in the ends of the barns, near the top, and a few side ventilators should be left open on the opposite side from which the wind is blowing. Heat causes the moist air to rise, and if it cannot escape readily the moisture collects in the top tiers, which may cause houseburn.

Some growers fire continuously, regardless of weather, until the crop is cured. Unless one is in a hurry to finish the curing or the barn is overcrowded, firing in good curing weather is probably a useless expense.

There is no evidence that a temperature higher than 75 degrees, F., on an average, is of any advantage in curing Burley. Probably very high temperature tends to give a leaf with harsh texture.

It pays to use heat when filling a barn if the weather is cold and windy at that time. Tobacco hanging in the barn after curing is completed should be dried out if it remains in very high order for more than two or three days.

Tobacco keeps its color and finish better if bulked as soon as fully cured. In warm weather, however, it must not be in very high order when bulked or it may be damaged severely.

STRIPPING AND SORTING WHITE BURLEY TOBACCO

When curing is completed and the leaves and midribs are thoroly dry stripping and sorting may begin as soon as the tobacco comes in "order" or "case;" that is, has taken up enough moisture to make the leaves pliable so they do not shatter in handling. To bring this about the air must be saturated or nearly saturated with moisture for several hours and the temperaure mild. A warm rain during the night followed by cloudy or foggy weather in the morning usually puts leaf in good order. If the temperature is low tobacco seldom takes up much moisture even when the humidity is high. When conditions become favorable ventilators should be opened to allow the moist air to circulate freely thru the barn but should be closed as soon as the tobacco handles well. Very high order, which means that the leaf is saturated with moisture, is not desirable as it may result in damage to the leaf after bulking.

When the weather during the fall is very dry, as in 1938, preparation for market may be greatly delayed because there is not sufficient moisture to bring the leaf in order. The only practical way to get a crop into condition for handling in such instances is by the use of steam and this method has been employed to a limited extent. Low pressure must be used to avoid damaging the leaf.

In the cigar-tobacco producing regions of New England cellars are built under the barns and the tobacco is brought into order by hanging it over night in the cellar. Such cellars might be useful in Kentucky.

Tobacco is kept in order by "bulking;" that is the tobacco is ricked with the tops of the plants overlapping in the middle and the butts on the outside. Tobacco should be pressed down firmly in bulking and weighted with tier rails or in some other way. The piles or "bulks" should then be carefully covered with tarpaulin, old blankets or pieces of old carpet to prevent loss of moisture. Usually tobacco is taken off the stick in bulking but occasionally when in very high order it is bulked on the stick. Some men bulk with the butts to the center, but this practice is not common.

Sometimes tobacco in the bulk becomes too dry to handle in spite of all precautions. Warm water sprayed on the butts of the stalks with a spray pump will often bring it back into order.

Early in the fall, while the weather is still warm and especially if the stalks are not perfectly dry, it is unsafe to make large bulks. The same thing is true when leaf is in very high order. Bulked tobacco should be examined occasionally to be certain it is keeping properly.

A well-lighted stripping room is necessary in order to sort leaf properly. The windows should face the north or, better, skylights in the roof may be provided using the same kind of glass as is used for the skylights in tobacco warehouses. In the latter case a stripping shed must be built outside the barn. This is preferable to a room in the barn whichever method of lighting is used. The stripping bench should be about 2½ feet wide and 3½ feet high. Four to five men can strip to advantage; hence the bench should be 18 to 20 feet long. The Kentucky Experiment Station can furnish plans for building a stripping room. These are sold for 20 cents in stamps or coin.

The object in sorting tobacco is to bring together leaves of similar quality. In White Burley separations are made by growers chiefly on the basis of weight or body of leaf, and color. Most workers depend largely upon color, however, in getting the leaf sorted properly, but color and body are closely related. It is not necessary nor now customary to make numerous divisions in sorting Burley leaf but every effort should be made to have each lot uniform in body and color, especially color. A few off-type leaves detract from the appearance of a lot of tobacco very greatly, and appearance has much influence in determining the price paid on the auction floor. The presence of an occasional leaf darkened by houseburn or heating is particularly objectionable. Any particular crop of tobacco is quite uniform for most characters, as a rule, and almost anyone can learn to sort Burley quite accurately after he has worked for a few weeks with men experienced in the work. Most poor jobs of sorting are the result of carelessness, and too much haste rather than a lack of ability.

Most Burley growers sort their crops into 8 to 10 so-called grades, including two or possibly more different lots of damaged leaf.

Some, however, sort very closely and make a large number of divisions. The tendency now, perhaps, is toward a small number. Generally the small, thin leaves at the base of the plant, often ragged and sometimes dirty, known as flyings, are separated into two lots on the basis of soundness. Just above the flyings are the lug leaves, considerably larger than the flyings, with more body and usually quite sound. The lugs in some crops may have consider-

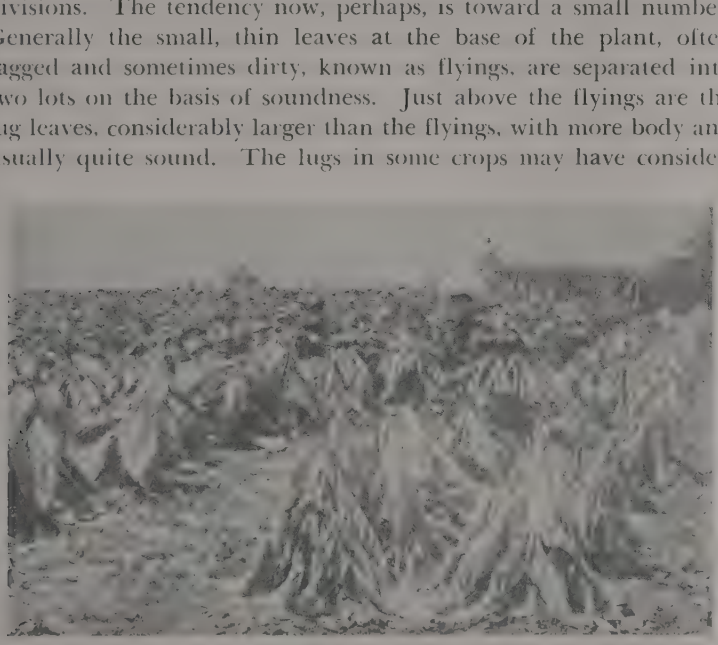

FIGURE 4. Tobacco cut ready to be put into the barn.

able body, especially those farthest up on the stalk. They are as a rule, the highest priced leaves on the plant and are used chiefly as cigarette cutters. However, good flyings sell for almost as much. In average crops it is not necessary to make any separation of the lug leaves. All the leaves above the lugs comprise what is known as the leaf group. The leaves in this group have relatively heavy body and are less colory than the lugs. The first two or three leaves above the lugs are lighter in body and more colory than those near the top and are separated from the latter in sorting, forming what farmers term the bright leaf grade. The heavy leaves are known as red leaf. Short leaves at the tip of the stalk are also kept separate. Usually the damaged leaves from various parts of the plant are separated into two or more lots.

In crops where the plants are irregular in size it is often necessary to make a large number of separations. In such crops sorting is simplified and a better job can be done if the plants are divided into three or four lots before stripping. One of these may consist of the undersized plants, one of plants on which the leaves have cured green and one of the best and soundest plants. Each lot is stripped and sorted separately.

Burley improves in appearance if left in the bulk for a week or two after stripping. The same precautions in regard to bulking should be taken as in case of unstripped tobacco.

FEDERAL TOBACCO GRADES

For some years the U. S. Department of Agriculture has been developing a system of grades for all types of tobacco grown in the United States. The set of grades for Burley tobacco provides for more than 52 individual grades based upon differences in color, quality, body of the leaf, etc.

The advantage of a standard system of grades lies in the ability to make market and price information available to all interested persons, on a uniform basis. Data as to market supplies and stocks of tobacco of various qualities can be developed for the purpose of planning for production or marketing activities. In many of the major agricultural products such as corn, wheat and cotton, official Federal grades are generally accepted by farmers and dealers and to a large extent are the basis of market trading. In tobacco the development of official grades has not progressed so far but Federal grades have been used to some extent on Burley tobacco markets since 1929.

On the markets where official grading has been carried on, price reports by grades are made available to both buyers and sellers for the purpose of guiding their marketing activities. Individual growers have a basis for logically deciding whether or not to accept or reject the bids placed on their tobacco and buyers have the benefit of the independent judgment of an experienced grader in deciding upon the grade and quality of tobacco. The tobacco grading service has in it the possibility of establishing a generally accepted measure of grade and quality of tobacco such as we have in the standard grades for many other farm products.

MARKETING

The loose-leaf system of marketing, by which practically all White Burley tobacco is now sold, has a most attractive feature, that of convenience. It is possible for the grower to sell any portion of his crop whenever ready for market, which is often desirable, not only because of financial considerations, but also because it gives space in the barn needed for taking down more tobacco and piling up stalks. Holding all the leaf until stripping is finished makes heavy loss in case of fire or windstorm.

Selling to the speculator is not likely to be a profitable practice. The speculator cannot long stay in business unless he makes a profit. Consequently, on the average, the prices he pays to growers are certain to be lower than floor prices.

It may be remarked that leaf in good order not only has a much more attractive appearance than that which is quite dry, but is heavier. It pays to sell if possible when moisture conditions are favorable for keeping the leaf in good condition. Very high order is not desirable, however, and buyers discriminate against "wet" tobacco.

DISAPPEARANCE OF BURLEY TOBACCO

Being consumed primarily in the domestic market Burley tobacco is influenced directly by changes in consumer incomes and market preferences in the United States. Altho consumption is relatively stable from year to year, production often varies widely because of changes in the acreage grown or the yields obtained per acre, or both. In planning future production, growers well may consider trends in market demand both as to the type and the total amount of tobacco required for use.

Burley tobacco is used for the manufacture of chewing and smoking tobacco and cigarettes. Cigarette consumption has increased tremendously in the past twenty years but the use of chewing and smoking tobaccos has declined. To meet this change Burley growers have produced a lighter type of tobacco and thus the use of Burley has been maintained or even increased. Overproduction can easily result, however, from marked increase in acreage.

Manufacturing companies normally carry large supplies of Burley tobacco in stock from year to year. Over a period of years,

however, annual purchases by manufacturers will about equal annual consumption. It is important, therefore, that production be adjusted to the amount needed for manufacure. During recent years about 315 million pounds of Burley tobacco have been used annually, as compared with about 290 million pounds ten years ago and 270 million twenty years ago. If Burley consumption remains near its present level, crops of a little over 300 million pounds should find ready sale for some years to come.

INSECT CONTROL

Tobacco horn-worm, usually called simply the tobacco worm, is the insect that must nearly always be combatted. It can be controlled effectively by dusting the plants with Paris green or lead arsenate. Paris green is very effective, but must be applied very evenly and sparingly to prevent burning the leaves. It is also irritating to the skin, and often the man dusting the tobacco suffers much discomfort. Lead arsenate does not burn the tobacco plants or cause discomfort to the man applying it. It sticks to the leaves better than Paris green and, consequently, is effective longer. It can be seen on the plants, which helps in getting it evenly distributed. It is not so effective in killing large worms as Paris green unless applied heavily. The Entomology Department recommends in using Paris green that it be mixed with six parts of slaked lime and applied with a rotary hand duster. A good fan duster is necessary for good distribution, but such a duster is decidedly preferable to the small bellows, even for Paris green.

Cutworms of various kinds often are troublesome both in the plant bed and in the field following transplanting. In the plant bed, thoro dusting with lead arsenate is usually quite effective. For severe and persistent attacks a poison bait should be tried. The one commonly used is made of bran, 25 lbs., Paris green, 1 lb., cheap molasses, 2 quarts, and enough water to give a thick mash. This should be broadcast over the bed in late evening at the rate of 4 to 5 pounds to 100 square yards of seed bed. The method of using in the field is to broadcast along the tobacco rows in the evening at the rate of 25 to 30 pounds per acre. The application should be repeated several times if necessary. Where only a little damage is being done in the field the most practical method is to replace the

plants that are cut off and at the same time destroy the worms that did the damage. Usually they may be found under clods near the recently cut off plant, waiting to cut off another plant the next night.

Wireworms, the larvae of the click beetle, often make it very difficult to get a stand of tobacco. They are likely to be particularly troublesome on sod land and on early set crops. When they are found to be damaging plants set early it is best to wait a week or ten days before setting more tobacco. A week's delay in transplanting often makes a great difference in the amount of injury done. Where large, stocky plants are set, they will usually live in spite of much tunnelling of the stem by wireworms and this is the best way to avoid serious losses of stand. It pays to plant seed beds very lightly in order that only stocky plants may be produced.

Fleabeetles are tiny insects which injure plants by puncturing the leaves and sucking out the juice. They sometimes become so numerous in plant beds as to completely destroy the plants, especially if the latter are still quite small. They are more troublesome in the southern part of the Burley district but in recent years they have caused considerable damage over all Burley territory. The Entomology Department of the Kentucky Experiment Station recommends dusting the plants either wih barium fluosilicate which is sold chiefly under the trade name Dutox, or with a mixture of 4 parts lead arsenate, and one part Paris green. Dutox gave slightly better results in tests at the Station. These dusts should also be used where the beetles are working on tobacco after transplanting. In some parts of Kentucky dusting alone is not sufficient to prevent injury in the bed. In such instances beds ought to be made very tight so the beetles cannot get into them readily. The sides and ends should be boxed with sound boards and earth piled up around the base. The tobacco cotton should be pulled over the top of the boxing and fastened to the sides of the boards so that no openings are left along the edge. A tight bed kept well protected is seldom injured by the beetles. Too, the arrangement solves the problem for slugs and cutworms in the bed.

Grasshoppers are often very troublesome on tobacco in late summer, especially in dry seasons when other forage is lacking. That close to a grass field may be practically ruined. Tobacco usually is so large at this time that spreading poison over all the

tobacco is not practical. If the plants on the outside of the field are dusted thoroly when depredations first begin, it may prevent further damage. The poison bait recommended for destruction of cutworms is also effective in destroying grasshoppers. It should be broadcast around the edge of the field in the very early morning.

FIGURE 5. Barn for air-curing tobacco.

TOBACCO DISEASES

Black root-rot is a soil-borne fungus disease attacking the roots of tobacco. It was formerly one of the most serious diseases of Burley tobacco, reducing the yield many millions of pounds annually. The development by the Experiment Station of excellent root-rot resistant varieties of Burley in recent years has made it possible to avoid practically all loss from this disease. The latest variety to be released, Kentucky No. 16, is not only very resistant to black root-rot but also is outstanding in both yield and quality of leaf. Evidence of this is the great popularity gained everywhere in the Burley district during the brief period since its introduction.

Black root-rot causes more or less rotting of the roots of tobacco plants, depending on the amount of soil infestation, which, of course, affects growth. On badly infested soil the tobacco may stand for weeks without making an appreciable growth. Growers

unfamiliar with black root-rot often attribute the injury to insects, particularly wireworms. Wireworms kill or weaken the plants by boring thru and destroying the underground part of the stem. In black root-rot the roots only are affected. Examination of an infected plant shows that the original roots are largely dead. These dead roots are black; hence the name black root-rot. A new root system may develop from the stem of an infected plant, near the surface of the ground, during hot weather when the disease is less active, and the plant may subsequently make a fair growth. On soil not heavily infested with the root-rot organism, the injury is not always easily recognized. When plants grow slowly in favorable weather and wilt during the day even when soil moisture is abundant, black root-rot is very likely to be the cause. Even when infection is not severe, yield is certain to be reduced. The most severe injury from black root-rot occurs when the growing season is cool and wet.

Where non-resistant varieties of Burley are grown, severe soil infestation may be avoided by practicing a rotation in which several years intervene between crops of tobacco, and by the use of a new plant-bed site each season. Two crops of tobacco followed by six to eight years of grass or other crops should keep the disease from causing serious injury.

Brown root-rot is a disease that affects the growth of tobacco in much the same way as black root-rot and it may easily be mistaken for the latter. The affected roots are not black, however, as in plants affected with black root-rot. Unlike black root-rot which persists in the soil and is most severe in fields frequently planted to tobacco, brown root-rot seems to be associated in some way with the crop preceding it in the rotation. In many instances subsequent crops of tobacco are not affected. Most of the commonly grown varieties of tobacco, including the black rot-rot resistant strains are about equally susceptible to brown root-rot. There is some evidence that varieties resistant to this disease may be produced.

Mosaic, also known as dry-weather french, walloon, and blue or black french, causes heavy losses to tobacco growers every year. Apparently, original infection in many fields in Kentucky is due to the use of natural leaf tobacco by the workers while weeding tobacco beds, pulling plants, and transplanting. Much of this natural

leaf carries mosaic, which is transmitted to the plants from the hands of the users. It has been demonstrated at the Kentucky Experiment Station, that if the workers abstain from the use of tobacco or use only sterile tobacco while working in or around the plant bed and setting the crop, mosaic can be held down closely. Tests indicate that manufactured tobacco does not spread mosaic as does natural leaf. Where workers feel that they cannot get along without using tobacco, it is suggested that only manufactured products be used when the operations named are in progress. In changing from the natural leaf to manufactured tobacco, pockets should be carefully cleaned out or fresh clothing worn. The hands should then be thoroly washed with soap and water.

By careful examination of the suckers just before tobacco is harvested, it is possible to determine which plants are affected with mosaic. If the affected plants are cut out in a portion of the field, chewing or smoking tobacco made from the remaining plants will be mosaic free and can be used instead of manufactured tobacco the following year.

Mosaic is responsible for one of the so-called "rusts" that often affect tobacco as it approaches maturity. Mosaic-affected plants usually produce an inferior grade of leaf; therefore it is highly profitable to take every possible precaution to prevent this disease from becoming established in tobacco fields. Mosaic resistance has been found in tobacco and it is expected that mosaic-resistant varieties will be introduced before many years.

Wildfire, angular leafspot and *blackfire* or rust have caused serious losses in the state at times, particularly in 1920 and also in 1938, in western Kentucky. As yet complete means of control have not been devised. Experiments indicate that infection of plant beds with wildfire or angular leafspot can be prevented by sprinkling or spraying the plants thoroly with Bordeaux mixture. Since the leaf diseases usually start in the fields from plants that become affected in the plant bed, it seems reasonable to believe that field infection might be avoided in many instances or at least delayed if only disease-free plants are set, thus reducing the injury that may occur before the crop is ready to harvest. In western Kentucky where angular leafspot and wildfire caused enormous losses in 1938,

FIGURE 6. Interior of loose-leaf warehouse.

it was determined that fields set with plants from beds that had been sprayed with Bordeaux mixture did not become infected until August the first, on an average, while fields set with plants from unsprayed beds showed severe damage two weeks earlier.

The cost of treating beds with Bordeaux mixture is very small and it is a wise precaution. Bordeaux mixture also acts as a repellant to certain insects, particularly flea beetles, that often cause trouble. The first application should be made when the plants are producing the first leaf or just before they are in the "square." A second application should be made about 10 days later. It is particularly important not to delay the first application. The mixture should be applied with an ordinary sprinkling can without removing the cotton cover from the bed. Poles or boards used to frame or box the bed should also be sprinkled. Fifty gallons of the mixture treats 200 square yards of bed. This is at the rate of one quart to each square yard of bed. The cost of material for treating 200 square yards of bed twice should not exceed 80 cents. Following are detailed directions for making Bordeaux mixture:

1. Fill a clean 50-gallon barrel or oil drum three-fourths full of water strained thru a cloth.

2. Thoroly mix 4 pounds of commercial hydrated lime in 3 or 4 gallons of strained water. Hydrated lime is the powdered lime in paper sacks commonly sold by lumber yards.

3. Dissolve 3 pounds of powdered bluestone in about 4 gallons of water in a wooden bucket or crock. If powdered bluestone, which dissolves readily, is not available, beat the crystals into a fine powder before trying to dissolve them. Your hardware dealer can get powdered bluestone for you.

4. Pour the lime paste into the barrel of water and stir. While stirring vigorously, add the bluestone solution slowly.

5. Add enough water to make 50 gallons.

6. Stir the mixture each time the sprinkling can is filled. CAUTION. The water, barrel, and other containers should be free from bits of material which will clog the rose of the sprinkler. The rose should be easily removable for cleaning.

Blue mold, a disease which has caused extensive damage to tobacco plants in the bed some years, in the southeastern states since

1930, appeared in Kentucky in 1937 and spread to plant beds in nearly all parts of the state in 1938. The first sign of it in a plant bed is likely to be a group of plants whose leaves turn yellow. It may then appear suddenly during a damp period over most of the bed causing large scalded spots on the leaves and in severe cases destruction of most of the leaves and death to some of the plants. At this time a moldy growth may be seen on the under side of some of the leaves. The surviving plants begin to recover in about a week or ten days and from that time on appear to be resistant to the disease. Recovered plants may be safely set in the field. Recovery is hastened by an application of nitrate of soda applied according to the directions on page 9.

There are several ways of reducing injury from blue mold. Growers claim that the application of Bordeaux mixture for the control of the leafspots has delayed the appearance of the disease in their beds a week or ten days beyond that of untreated beds, which is often sufficient to complete planting. The disease frequently appears first in beds used the previous year and spreads from these to other beds in the neighborhood; therefore all growers should use new bed sites each year.

Blue mold is usually much more severe in beds located in woods or it may start in a small portion of a bed shaded in the morning by a nearby tree. The beds should be located, therefore, in an open area. Removal of cotton from the bed during the day following the first appearance of the disease in the neighborhood toughens the plants and slows down the spread of the disease. The disease can be satisfactorily controlled by spraying with copper oxide-Lethane-oil spray twice a week beginning with the first appearance of the disease in the neighborhood but before its appearance in the bed to be protected. Special directions should be obtained before attempting to use this spray.

Complete control can be obtained by the use of benzol evaporated in the bed and held in by tight sides and a 60-thread cotton cover rather than the more open one usually used. Paradichlorobenzene commonly used in the control of peach-tree borers is also effective in preventing the disease or stopping it after it has started. Both these materials can cause serious injury to plants and so should be used only after proper instructions have been obtained. It is

entirely probable that the majority of growers, for the next few years will rely on cultural practices, rather than spraying or gassing, to take care of this disease. Experience will tell whether or not the more expensive control measures will be necessary.

Fusarium wilt is a disease which is becoming common in sandy soils bordering rivers and streams and occasionally in other localities. The plants may be affected at any age. The leaves on one side of a plant turn yellow and later wilt and die. On cutting the stem across it is found to have a dark line under the bark only on the affected side. The disease has been noticed particularly on White Burley tobacco. It may be prevented by the use of a resistant variety. Several fairly good resistant varieties of White Burley have been developt by the Experiment Station and are being introduced into areas where the disease is a factor.

Streak is a virus disease somewhat similar in nature to mosaic. It is spread by insects. It occurs in all parts of the state but the worst outbreaks have occurred in the northernmost counties of Central Kentucky. Dead streaks suddenly appear in the upper part of the stem and young leaves and the inside of the stems has pockets of dead tissue. The plants appear as tho they would die but gradually renew growth and appear fairly normal, so that much less injury results than anticipated.

LIGHTNING INJURY

Not infrequently tobacco is injured by lightning, resulting in a condition often mistaken for a rapidly spreading disease. Usually all the plants in a circular area are killed or severely injured, the damage becoming less farther from the center. The roots are unaffected. The stalk usually is shriveled and leathery. The midveins of the leaves may be killed and drawn, giving the leaves a puckered appearance.